

CLAIMS

1. A method of fabricating a membrane structure for micro-machined devices, the method comprising:
- 5 providing a substrate,;
- forming a microstructure on a back side of the substrate;
- depositing a precursor solution on a front side of the substrate after
- forming the microstructure while rotating the substrate to form a thin
- film layer thereon
- 10 2. The method as recited in claim 1, further comprising seating a periphery portion of the substrate over a base plate to form a spacing between the microstructure and the base plate.
- 15 3. The method as recited in claim 2, wherein the periphery portion of the substrate is seated on a ridge projected from the base plate to form a spacing between the microstructure and the base plate.
- 20 4. The method as recited in claim 3, further comprising sealing the periphery portion of the substrate on the base plate with the ridge to isolate the microstructure from the precursor solution.
- 25 5. The method as recited in claim 1, further comprising forming a high-pressure zone surrounding the periphery portion of the substrate to prevent the precursor solution from contacting the microstructure.
- 30 6. The method as recited in claim 1, further comprising, before forming of the thin film layer, depositing an intermediate layer and a first electrode layer on the front side of the substrate.

7. The method as recited in claim 6 further comprising, after formation of the thin film layer, crystallizing the thin film layer by annealing.
8. The method as recited in claim 7, further comprising, after crystallizing the thin film layer, depositing a second electrode layer on top of the thin film layer.
9. The method as recited in claim 8, further comprising etching through the substrate, the intermediate layer, the first electrode layer, the thin film layer and the second electrode layer to form a cantilever-structured micro-machined device.
10. The method as recited in claim 8, further comprising etching through the substrate, the intermediate layer, the first electrode layer, the thin film layer and the second electrode layer to form a bridge-structured micro-machined device.
11. The method as recited in claim 1, wherein the micro-machined device is a piezoelectric based MEMS device and the thin film layer comprises a piezoelectric film.
12. The method as recited in claim 9, wherein the cantilever-structured micro-machined device is a piezoelectric based MEMS device and the thin film layer comprises a piezoelectric film.
13. The method as recited in claim 10, wherein the bridge-structured micro-machined device is a piezoelectric based MEMS device and the thin film layer comprises a piezoelectric film.
14. The method as recited in claim 1,

wherein providing a substrate further comprises providing a first substrate and a second substrate having each a back side, a front side and periphery portion;
wherein forming a microstructure on the back side of the substrate further comprising forming a microstructure on the back side of the first and the second substrates, and
the method further comprising joining the first and the second substrates with the back sides facing each other;
wherein supporting the substrate for rotation further comprising supporting the joint first and the second substrates for rotation; and
wherein depositing a precursor solution and rotating the substrate further comprising depositing a first precursor solution on the front side of the first substrate, rotating the joint substrate to form a first thin film layer on the front side of the first substrate, depositing a second precursor solution on the front side of the second substrate, and rotating the joint substrate to form a second thin film layer on the front side of the second substrate.

15. The method as recited in claim 14, wherein supporting the joint first and the second substrates further comprising seating the periphery portion of the first substrate over a base plate to form a spacing between the first substrate and the base plate to expose the front side of the second substrate for precursor solution deposition thereon.

16. The method as recited in claim 15, further comprising, after formation of the thin film on the front side of the second substrate, seating the periphery portion of the second substrate over the base plate to form a spacing between the second substrate and the base plate to expose the front side of the first substrate for precursor solution deposition thereon.

17. A micro-machined device comprising a substrate, a microstructure formed on a first side of the substrate, a thin film layer formed on a second side of the substrate, wherein the device being formed according to a method as recited in claim 1.
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18. A substrate support for protecting a microstructure of a substrate during solution spin deposition, comprising:
- a rotatable base plate having a top surface;
 - a seat coupled to the base plate for receiving the substrate to form a
 - 10 contacting interface, wherein the contacting interface is to separate the microstructure from the base plate, and
 - a retaining member coupled to the base plate for securing the substrate to the base plate;
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19. The substrate support as recited in claim 18, wherein the substrate and the base plate form an air gap surrounding the contacting interface for generating a high-pressure zone during rotation of the base plate to prevent the microstructure on the back side of the substrate from being
- 20 contacted.
20. The substrate support as recited in claim 19, wherein the base plate further comprises a conical side wall extending outwardly and downwardly from the air gap for providing an aerodynamic transition from the high-pressure
- 25 zone.
21. The substrate support as recited in claim 18, wherein the seat comprises a shoulder projected from a periphery portion of the base plate for contacting the substrate.
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22. The substrate support as recited in claim 18, wherein the seat comprises a spacer disposed between the substrate and a peripheral portion of the base plate for contacting the substrate.

23. An MEMS device comprising:

a substrate having a first side, a second side opposite to the first side and a cavity formed between the first side and the second side;

a first piezoelectric thin-film structure formed on the first side of the substrate; and

a second piezoelectric thin-film structure formed on the second side of the substrate.

24. The MEMS device as recited in claim 23, wherein the first and the second piezoelectric thin-film structures are independently controllable.

25. The MEMS device as recited in claim 23, wherein the substrate being silicon wafer substrate.

26. The MEMS device as recited in claim 25, wherein the silicon wafer substrate being formed of two parts jointed at a temperature higher than that for forming the first and the second piezoelectric thin-film structures.